

follows: North Dakota, 2.24 inches, +0.42 inch; Minnesota, 4.13, +2.62; South Dakota, 3.70, +2; Wisconsin, 6.02, +3.45; Iowa, 3.43, +0.98; Missouri, 2.93, +0.71; Indiana, 5.09, +3.07; Illinois, 2.86, +0.59.

SUNSHINE AND CLOUDINESS.

The average number of clear days was 11; partly cloudy, 7; cloudy, 12. There was less sunshine than is usual in October.

WIND.

Northwest winds prevailed. The highest velocity reported was 48 miles an hour from the east at Minneapolis, Minn., on the 6th.

RIVERS.

The heavy rains during September and the first six days of October caused unusually high stages in the rivers, and especially the smaller streams, in Wisconsin, Illinois, eastern Iowa, and northeastern Missouri. Much damage was done to dams, mills, and crops by the floods on the Wisconsin, Black, and Chippewa Rivers, and there was considerable damage done to crops in Illinois, southeastern Iowa, and northeastern Missouri. The Wisconsin River flood was the most serious on that river since October, 1900, and with that exception the water was the highest in 30 years. The Mississippi River from Dubuque to La Crosse was the highest since July, 1908. The river rose steadily at all stations in the Davenport district during the second decade of the month. While the high water was unusual at this season of the year, the crest of the rise was everywhere considerably below the flood stage, and no damage of any consequence was reported. At Keokuk the river rose steadily after the 13th, and by the 17th work on the Illinois division of the Mississippi Water Power Dam was suspended, as the river flooded the cofferdams. The floods and high water in central Illinois caused much damage. Bridges and culverts were carried away and railroad embankments were washed out. At Vandalia, on the 4th, the Kaskaskia River had reached the highest stage ever known. Breaks occurred in the levee and much land was inundated. The Illinois River at Beardstown overflowed its banks. Mr. S. P. Peterson, official in charge, local office, United States Weather Bureau at La Salle, Ill., reports that the average flow of the Illinois River was the highest for any October in the seven years' history of the station. The river was above the flood stage from the 3d to the 10th, inclusive, but there was very little damage done in the bottom lands by the flood.

Mr. Montrose W. Hays, district forecaster, St. Louis, Mo., reports:

The stage of the Mississippi River was higher than normal, and the high stage seriously interfered with the work on the "free bridge." At one time it was thought that all the false work would be washed away, and all work of construction was suspended and every effort was made to protect the work. The channel scoured 19 feet, and it took many carloads of sand and stone to prevent a complete washout.

WISCONSIN RIVER FLOOD OF OCTOBER, 1911.

By J. H. SPENCER, Local Forecaster, Dubuque, Iowa.

The Wisconsin River flood of October, 1911, was the most serious on that river since October, 1900, and with that exception the highest water in 30 years was experienced. The losses to dams, mills, crops, etc., amount approximately to \$300,000. It is probable that property saved as the result of flood warnings exceeded the losses.

Less damage occurred below Wausau and vicinity than during October, 1900, although there was very

little difference in the stages of the two floods, as shown by the following table:

	Highest stage—	
	October, 1900.	October, 1911.
	<i>Feet.</i>	<i>Feet.</i>
Wausau, Wis.....	11.2	11.2
Grand Rapids, Wis.....	14.2	13.6
Portage, Wis.....	12.2	12.9

¹ River gauges were not maintained at Wausau and Grand Rapids in October, 1900, but the stages were obtained a year or so ago with reasonable accuracy from reference marks on the foundation walls of buildings.

² Or slightly over.

³ There were no breaks in the levees this year, while in October, 1900, the water broke through and flooded lowlands. This fact undoubtedly explains the difference in the stages of the two floods at Portage.

CAUSES OF THE FLOOD.

In September, 1911, the average rainfall for the Wisconsin Valley from Portage to Rhinelander was about 5.98 inches, or 2.56 inches above normal. This exceptionally heavy rainfall thoroughly soaked the ground, and raised the rivers of the upper Wisconsin River system to rather a high stage for September. There was, in fact, considerable uneasiness in the vicinity of Wausau because of high water at the beginning of October. Then came the extremely heavy rains of the first 6 days of October, which gave the following amounts:

	Inches.
Rhinelander.....	4.34
Merrill.....	5.05
Wausau.....	5.52
Stevens Point.....	4.27
Grand Rapids.....	4.24

About one-half of this amount fell in 12 hours on the night of the 5th-6th, Wausau reporting 2.55 inches and Rhinelander 2.80 inches at 7 a. m. of the 6th.

As the result of these rains, the Wisconsin River at Wausau rose from 6.7 feet at 7 a. m. of the 5th to a crest of slightly over 11.2 feet at 2 a. m. of the 7th; at Grand Rapids from 8 feet at 7 a. m. of the 6th to 13.6 feet at midnight of the 8th; at Portage from 6.9 feet at 7 a. m. of the 6th to 12.9 feet at 6 p. m. of the 11th.

DAMAGE AT WAUSAU AND VICINITY.

The excessive rainfall that was the immediate cause of the flood at Wausau fell during the night of the 5th-6th, and within 18 hours from the time it ceased the flood crest at Wausau was reached. On the morning of the 6th, immediately upon learning the amount of rain that had fallen during the previous night, a flood warning was telegraphed to the mayor of Wausau. Warnings were issued later in the day for Stevens Point and other cities and towns southward to Portage.

About 11 o'clock on the morning of the 6th the east gate of the guard lock at Wausau gave way, and early in the afternoon of the same day the top section of the dam at Kelly was carried down the stream. These two breakages were in large part the cause of much of the damage at both Wausau and Rothschild. When the guard lock broke, the mill of the Alexander Lumber Co. was flooded, and this firm sustains a loss of about \$6,000. The Wausau Street Railway Co. reports damage amounting to about \$2,000, and there were a number of minor losses.

By far the greatest damage on the Wisconsin River was sustained by the Marathon Paper Mills Co., of Rothschild, a few miles below Wausau. The damage to

this property is given in the following letter from Mr. D. C. Everest, secretary and manager:

It is not possible for us to give a close estimate of our loss at the present time (Oct. 21, 1911), but presume it will reach about \$150,000. We still have high water, and it is impossible to investigate the conditions around the end of our dam to know just what shape the main structure is in. There was no failure of the dam itself, but we were compelled to blow out the west bank of river around the end of dam in order to save the mill buildings, due to the clogging of our gates with refuse which came down the river soon after the breaking of the guard lock at Wausau and the carrying away of the slash boards at Kelly.

The town of Schofields was flooded, and damage to residences, etc., amounted to several thousand dollars. Above Wausau the damage was not great. At Merrill it amounted only to about \$500.

FROM STEVENS POINT TO KILBOURN.

The damage at Stevens Point was small, and it will cost the city only about \$200 to repair roads and bridges. Water surrounded a number of homes, and cellars were flooded. The chief loss to the mills was owing to the necessity of closing down for a day or two. In the surrounding country much damage was done to crops and roads, Postmaster D. E. Grost estimating the losses at about \$10,000. A young man by the name of Isadore Cvik, living 14 miles north of Stevens Point, was drowned while attempting to rescue cattle from the flooded fields.

Relative to the warnings of the Weather Bureau, Mayor F. A. Walters writes:

The millmen, and others as well, certainly took special precautions because of your timely warnings * * * and all assure me the efforts in their behalf were appreciated. * * *

At Grand Rapids the water rose to a crest of 13.6 feet. The losses, nevertheless, amounted only to a few thousand dollars. The city authorities made every effort to keep the water off the business streets, and they succeeded. Merchants lost much less than in October, 1900, because they removed their goods from basements well in advance of the flood. The greatest single loss at Grand Rapids was about \$2,000 by the Consolidated Water Power and Paper Co., owing to the necessity of replacing timbers in the sluiceways and along the spillways of the dam and for other repairs. The manager, Mr. George W. Mead, writes:

The water companies suffered very little loss in this locality on account of the flood. We were all warned well in advance, and were able to make preparations to pass the water through our dams. None of us suffered at all on account of the dams. We had no damage whatever to milling property. We wish to thank you for your thought and promptness in notifying us of the coming high water.

Crop losses in the vicinity of Grand Rapids were several thousand dollars. There was no loss from Nekoosa to Kilbourn, except to crops on lowlands. Mr. L. Kleimenhagen, of Kilbourn, states that the warnings of the Weather Bureau gave the people located on the lowlands a chance to save a good deal of their property.

Postmaster T. H. Marshall, of Kilbourn, writes on October 29, 1911:

I have made considerable inquiry about the damage to farmers by the recent floods in this vicinity, and on good advice I set the amount at \$25,000, vicinity meaning halfway to the next town both up and down the river. This does not include the damage to the dam here, which is considerable—possibly many times the above amount.

THE FLOOD AT PORTAGE.

The river at Portage rose to 12.9 feet, the highest ever known there. This was due, however, to the fact that there were no breaks in the levees. The volume of

water was just about the same as during the flood of October, 1900, while it was slightly greater than during the flood of June, 1905, and considerably less than during the floods of 1880 and 1881.

It was, however, only by the hardest kind of work upon the part of city officials and the members of the State levee commission, with their assistants, who worked night and day for several days, that the losses in the city were trivial. The tracks of the Chicago, Milwaukee & St. Paul Railway Co. were washed out, but only for a distance of about 200 feet; repairs were made at a cost of only \$150 for labor and the use of 40 carloads of cinders. The estimated loss to crops on lowlands in the vicinity of Portage is \$8,000.

Relative to the flood and the warnings of the Weather Bureau, Mayor M. J. Downey says:

I have received your many telegrams and communications relative to what we might expect in regard to the flood raging on the Wisconsin River. * * * We managed to handle and control all the water passing through this locality, but it was only by giving our levees strict and undivided attention throughout the raise of the water. * * * We people here in Portage believe that we are similarly situated with the people of Black River Falls, for if the locks in the canal at the Wisconsin River should ever give way it would be impossible to save any great portion of our business section. * * * I desire to personally and sincerely thank you for your vigilance in keeping us informed as to the conditions we might expect, and it was certainly through your efforts that we were able to effect the results which fortune seemed to favor us with.

Under date of October 30, 1911, Postmaster T. J. Welks, of Portage, Wis., writes:

Had it not been for your timely warnings the river would have broken through the levee in many places, and the loss without doubt would have reached \$500,000 in this locality, to say nothing about the enormous loss all down the Fox River Valley. It was by the most strenuous efforts by the city officials, levee commission, and railway company that the river was kept within its banks. The citizens of this locality owe the Weather Bureau a debt of gratitude for the accuracy of its forecasts and the timely warnings.

LOSSES BELOW PORTAGE.

The losses below Portage, amounting to \$10,000 or more, were confined almost exclusively to crops on lowlands, except at Prairie du Sac, Wis., where the Wisconsin River Power Co. is building an immense dam. Under date of October 19, 1911, Mr. R. G. Walter, resident engineer of this company, stated that the water continued so high that it had been impossible to estimate the amount of damage.

The following extracts from letters received from postmasters of towns below Portage are of especial interest:

Prairie du Sac: Your timely warnings were well heeded, especially by local authorities in guarding the bridge approach and by business men in removing stocks from their cellars. Farmers saved considerable hay; about 20 or more stacks were damaged or destroyed.

Lone Rock: Some of the hay men took advantage of the warning and saved most of the crop. Others seemed to think it would not be much of a flood and lost; about 300 tons were lost; value, \$3,000.

Boscobel: Farmers had ample time to get everything out of lowlands, but some did not do it; one piece of corn of 20 acres was carried away.

Warnings were issued to all towns below Portage on October 8.

SECOND FLOOD, WISCONSIN RIVER, OCTOBER, 1911.

A second flood occurred on the Wisconsin River in October, 1911, beginning on the 17th, but it was not of very great importance. It was caused by heavy rains in northern Wisconsin from the 14th to the 16th, inclusive. At Rhinelander, Wis., for instance, the rainfall was 3.79 inches during the period mentioned, and 1.61

inches of this amount fell during the 24 hours ending at 7 a. m. of the 17th.

The highest stage at Wausau was 8.4 feet on the afternoon of the 17th, the highest at Grand Rapids was 9.4 feet during the daylight hours of the 19th, and the highest stage at Portage was 10.9 feet throughout Sunday, the 22d.

A WORD AS TO FUTURE FLOODS.

The great floods of the past on the Wisconsin River will be duplicated in the future—but when, no one knows. Popular notions that the destruction of forests, the cultivation of the soil, etc., have materially altered climatic conditions are erroneous. As in the past, the floods of the future depend almost entirely upon the distribution and amount of precipitation.

Towns and cities in the Wisconsin Valley are growing in size and importance. Property subject to damage during floods is increasing enormously. Immense dams are converting portions of the river into great artificial lakes. These are among the reasons why localities that are subject to damage should guard against it by frequently inspecting and repairing levees, guard locks, etc., during periods of low water.

HIGH WATER FROM DUBUQUE TO LA CROSSE.

The rainfall at the headwaters of the Mississippi River was about the same as already stated for the upper Wisconsin Valley. For instance, the September rainfall at St. Paul was 5.27 inches, or 1.85 inches above the normal. This amount was followed by 5.58 inches during the first six days of October. Similar conditions also caused the severe floods on the Black River.

As the result of these conditions the Mississippi River from Dubuque to La Crosse was the highest since July, 1908. The rise was further increased from Dubuque to Prairie du Chien by the flood from the Wisconsin River, and also by a general rain from October 13 to 16, which gave from 2 to 3 inches from Prairie du Chien to north of La Crosse.

At Dubuque the river rose from 3.6 feet on the 2d to 14.6 feet on the 18th and 19th. This rise of 11 feet has never been equaled during any October since the station was established 38 years ago, although during two previous Octobers the maximum stage was higher.

The highest water was about 3 feet below flood stage both at La Crosse and Dubuque. Warnings of the approaching high water were nevertheless given through the newspapers and The Daily River Bulletin, marked copies of which were sent to postmasters.

Nearly every postmaster from Dubuque to below La Crosse reports damage to crops, particularly hay, which was cut and stacked, and the losses may reach \$100,000. Owing to a long period of low water, lasting several years, lowlands and islands were cultivated this year to an unusual extent, and this fact explains the heavy loss. The amount of crops saved after warnings were given probably exceeded the amount lost, but in many instances the heavy rains which preceded the floods for a number of days or weeks made it impossible for farmers to get into their fields.

From among the many letters received relative to the high water in the Mississippi River the following extracts are taken:

Postmaster Charles P. White, Stoddard, Wis.:

The damage by recent floods in this vicinity is wholly in bottom lands of the Mississippi. Estimated loss of hay, 3,000 to 4,000 tons, valued at about \$30,000. Quite an amount was saved by farmers having available flats to float their hay to shore.

Postmaster, Lansing, Iowa:

About 1,000 bushels of corn were saved; none was totally destroyed, but some was damaged to the extent of \$250. Two hundred tons of hay were destroyed; value, \$1,600.

Mr. M. O. Dulphy, Harpers Ferry, Iowa:

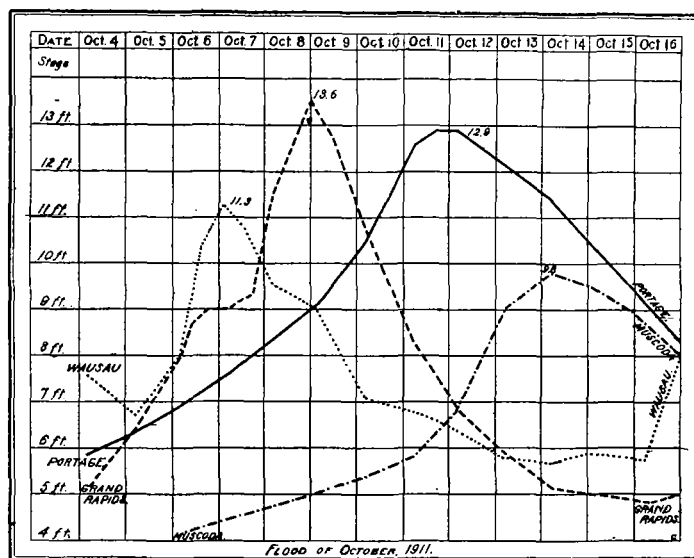
The loss to hay, corn, and potatoes in this vicinity amounted to about \$500. I had 50 head of cattle, 75 hogs, 100 tons of hay, and some other crops on the island, all of which I saved, as I used my River Bulletin as a guide.

Mr. J. A. Gillis, Prairie du Chien, Wis.:

The warnings were of great benefit. Farmers put large forces of men to work, and the greater portion of the crops was saved.

Postmaster Walter Kimball, Cassville, Wis.:

Losses in this vicinity: Six hundred tons of cabbages, value \$2,500; field corn destroyed, \$2,500; damaged, \$500; hay and sweet-corn fodder destroyed, \$1,000. If the farmers had taken better warning of your forecast the loss would not have been so heavy, but they could not believe the water would reach such a high stage. They now believe in the accuracy of your forecasts and will appreciate the service.



Wisconsin River Stages.

FLOOD REPORT.

By B. L. WALDRON, Official in Charge, Hannibal, Mo.

The excessive rains of September 25, 27, and 28, and October 1, following the frequent heavy rains that had fallen earlier in September, caused a flood in the North and South Fabius and in North and South Rivers that did a great amount of damage in the valleys of those rivers and in the Mississippi bottom lands across from Quincy, Ill.

The bottom lands were completely overflowed and the corn that was cut and in shock was either carried away or ruined, and that which was standing was injured. Thousands of tons of prairie hay was ruined as well as all the wheat that had been sown.

The levee at Taylor, Mo., was saved by great effort, all the men available working on it for two days and nights.

The O. K. Railroad lost about 100 feet of track just west of Taylor, Mo., and the Chicago, Burlington & Quincy had a weakened embankment near Moody or Dunsford, Mo., which caused them to detour trains for part of a day.

The damage to property except crops was probably \$500; the damage to crops was probably \$10,000. There was no special damage from erosion or deposit nor by suspension of business.